

Claims

1. (Currently Amended) Procedure for etching of materials at the surface by focussed electron beam induced chemical reaction at the surface, with the following steps:

5 a) in a vacuum atmosphere the material which is to be etched is irradiated with at least one beam of molecules and at least one first beam of electrons, whereby the irradiated material and the molecules of the beam of molecules are excited in a way that a chemical reaction takes place and forms a reaction product, which is not gaseous /not volatile ~~[[--]] reaction-step [[--]]~~ ,

10 characterized in that

b) the reaction product is evaporated from said surface by an a second beam of electrons, which heats the material locally to a temperature above the vaporisation temperature of the reaction product ~~[[--]] removal-step [[--]]~~.

2. (Original) Procedure according to claim 1, characterized in that an electron
15 beam generating electron beam column is provided which generates said first as well as said second beam of electrons.

3. (Previously Presented) Procedure according to claim 1, characterized in that said second beam of electrons is generated in a different setting over said first beam of electrons, using the same lenses of the system, but selecting a different aperture
20 electronically by beam deflections and timing the interaction in μ sec to msec intervals.

Claims 4-18 (Cancelled)

19. (Previously Presented) Procedure according to claim 2, characterized in that said second beam of electrons is generated in a different setting over said first beam of electrons, using the same lenses of the system, but selecting a different aperture
5 electronically by beam deflections and timing the interaction in μsec to msec intervals.

20. (Previously Presented) Procedure according to claim 1, characterized in that said second beam of electrons is generated in a pulsed and/or focussed way.

21. (Previously Presented) Procedure according to claim 2, characterized in that said second beam of electrons is generated in a pulsed and/or focussed way.

10 22. (Previously Presented) Procedure according to claim 3, characterized in that said second beam of electrons is generated in a pulsed and/or focussed way.

23. (Previously Presented) Procedure according to claim 19, characterized in that said second beam of electrons is generated in a pulsed and/or focussed way.

15 24. (Currently Amended) Procedure according to claim 1, characterized in that initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[-]] cleaning step.~~

25. (Currently Amended) Procedure according to claim 2, characterized in that initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[-]] cleaning step.~~

20 26. (Currently Amended) Procedure according to claim 3, characterized in that

initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[~]] cleaning step.~~

27. (Currently Amended) Procedure according to claim 19, characterized in that initially the surface of the material to be etched is cleaned by thermal desorption with the
5 electron beam heating ~~[[~]] cleaning step.~~

28. (Currently Amended) Procedure according to claim 20, characterized in that initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[~]] cleaning step.~~

29. (Currently Amended) Procedure according to claim 21, characterized in that
10 initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[~]] cleaning step.~~

30. (Currently Amended) Procedure according to claim 22, characterized in that initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[~]] cleaning step.~~

31. (Currently Amended) Procedure according to claim 23, characterized in that
15 initially the surface of the material to be etched is cleaned by thermal desorption with the electron beam heating ~~[[~]] cleaning step.~~

32. (Currently Amended) Procedure according to claim ~~24~~ 25, characterized in that the step of cleaning step is realised by includes a further chemical reaction forming a
20 further reaction product to remove contamination, oxides or other the material covering

surface layers.

33. (Previously Presented) Procedure according to claim 32, characterized in that the further chemical reaction is induced by at least one additional beam of molecules.

34. (Currently Amended) Procedure according to claim 33, characterized in that the material covering the surface layer is formed by carbon contamination and said at least one additional beam of molecules comprising water, hydrogen peroxide ~~hydrogenperoxyde~~, chlorine or other halogen compounds which release excited halogen atoms to react with the carbon from said surface layer.

35. (Currently Amended) Procedure according to claim 32, characterized in that the further chemical reaction is induced by at least one additional beam of molecules and a third beam of electrons, with high current density, preferably in the range of 0 to 10 C/cm² and being well focussed.

36. (Previously Presented) Procedure according to claim 35, characterized in that the material covering the surface layer is formed by silicon oxides on silicon and said at least one additional beam of molecules comprising chlorine or other halogen compounds which releases excited halogen atoms under irradiation with said third beam of electrons and react with the silicon oxides and coating layer under electron beam excitation to said further reaction product.

37. (Currently Amended) Procedure according to claim 32, characterized in that in the case the further reaction product is not gaseous/volatile then the further reaction

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product is evaporated by heating the surface of the area to be cleaned with a fourth focussed beam of electrons having sufficient power density or energy density to heat the surface to a temperature above the vaporization temperature of the further reaction product.

5 38. (Previously Presented) Procedure according to claim 35, characterized in that said third and/or fourth beam of electrons is/are generated in a different setting over said first and/or second beam of electrons.

 39. (Currently Amended) Procedure according to claim 35, characterized in that said an electron beam generating electron beam column generates the third and fourth
10 beam of electrons.

 40. (Previously Presented) Procedure according to claim 1, characterized in that said at least one beam of molecules is consisting of selected chemical compounds in a stoichiometric composition issued from a gas feeding system to the material surface during said reaction step.

15 41. (Currently Amended) Procedure according to claim 1, characterized in that also molecules are issued with ~~the~~ a multi-jet supply that ~~contain~~ contains a catalyst to enhance the chemical reaction and to generate in a subsequent etching step reactive products, which then can be removed by thermal desorption, or which are already volatile themselves.

20 42. (Withdrawn) Device for carrying out the procedure according to claim 1

having an electron beam generating electron beam column with a control device to switch between predetermined positions delivering different power for said electron beam generating electron beam column and insofar different intensities of said beams of electrons.

5 43. (Canceled)

44. (Withdrawn) Device according to claim 42, characterized in that said control device further controls deflection means for the different beam of electrons.

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